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Laying performance and egg quality traits of Hansli x CSML birds under different rearing systems

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Abstract
The study evaluated the effects of rearing systems (intensive and semi-intensive) on the laying performance and egg quality traits of Hansli x CSML birds. 186 day old chicks were divided randomly and reared separately under the two systems. At the end of growing period, the remaining female birds in each system were observed and recorded for egg production from date of first lay up to 40 weeks of age and egg quality traits were recorded at 40th week. The data revealed that birds under semi-intensive system had significantly lower age at sexual maturity as compared to their intensive counterparts while the reverse was true for egg production. It was also observed that the rearing systems had significant effect on different egg quality traits like egg weight, albumen index, yolk index and Haugh unit. The egg quality traits of crosses under study are desirable for handling pressure of traditional rural farming practices.

Keywords: Cross, egg, intensive, semi-intensive

Introduction
In, India, there are two types of poultry rearing, commercial poultry rearing and the rural or family poultry rearing. Commercial rearing of poultry is mainly done under an intensive system (deep litter and cage system). This rearing system used in highly productive farms is often subjected to harsh criticism, one of the reasons being its failure to provide adequate welfare to the reared birds. In many countries, this attitude has led to the production of poultry under less intensive rearing conditions to promote the psychological state and welfare of poultry birds. Consequently, there has been a renewed interest in free-range poultry farming in developed countries [19]. Though India has shown tremendous growth in commercial poultry production over decades, rural poultry farming is still lagging behind and always found neglected. In rural areas, poultry birds are kept under a wide range of conditions which can be classified into either free-range/backyard or semi-intensive systems [2]. When raised on open pasture, birds can roam around freely and express their natural behaviours and exposed to less stress [18, 21]. Poultry rearing systems like the semi-intensive system is among the up to date alternative system that supports the birds' welfare as well as improves the living standards of the rural households by supplying additional income and supplementing protein intake via eggs and meat in rural and tribe folks [10]. For centuries, poultry eggs constitute an essential food source for humans of all ages. Production of both egg and chicken meat has certainly assisted in reducing the gap in the supplies of animal protein for human consumption [20]. The egg is considered by W.H.O. as a "perfect natural food". It is a rich source of dietary nutrients like proteins, lipids, vitamins and minerals and is highly digestible in nature. The evaluation of external and internal quality of the egg is essential as consumers prefer better quality eggs. Many factors such as breed, variety, strain, environmental conditions, rearing practices and season, influence the egg quality, fertility and hatchability. The success of poultry farming largely depends on the production of the total number of good quality eggs. Though many works have been carried out on egg quality traits, the information on varieties developed and being popularized for backyard farming in rural and tribal areas are limited. In this context, the present study was aimed at assessing the effects of different rearing systems (deep litter and semi-intensive) on production performance and egg quality traits of Hansli x CSML crossbred birds in Odisha.

Materials and Methods

Location of study

The study was undertaken in the AICRP on "Poultry Breeding" farm PG Department of Poultry Science, College of Veterinary Science and Animal Husbandry, Odisha University of Agriculture and Technology, Bhubaneswar.

Experimental design and management

F1 crossbred progenies were obtained by mating adult Hansli males and Colour synthetic male line (CSML) females. One hundred eighty six (186) day old Hansli x CSML chicks were randomly collected and brooded up to 6 weeks of age after which they were randomly divided into two groups and reared separately under intensive and semi-intensive systems up to 20 weeks of age. During brooding, chicks were provided floor space @0.5sq ft / chick and floor space @1 sq.ft. / bird from 3-6 weeks. During the grower and layer stages, birds under both systems were provided coop floor space @2.5 ft^2/bird and an additional pasture run space @15 ft^2/bird was available only for birds under semi-intensive system. The pasture run space was fenced around to avoid predatory attacks. The chicks were exposed to 23 hours of lighting and a dark period of 1 hour per day up to 6 weeks. From 7th week onwards the birds were maintained under natural daylight till 20th week of age. After completion of 20th week of age, 42 female birds of intensive system and 48 female birds of semi-intensive system were divided into 3 replicates each. From 21st week lighting hours was gradually increased by 30 minutes/week till 16 hours per day was reached. Separate experimental diets as per A.O.A.C (1995) [1] were prepared for chick (20 % CP and 2866 kcal/ kg ME), grower (18 % CP and 2822 kcal/kg ME) and layer (20 % CP and 2860 kcal/kg ME) birds and fed to them. During grower and layer phase, birds under intensive system were fed a requisite amount of experimental diet while birds under semi-intensive system were fed 50% of the amount allocated to birds under intensive system and were left to scavenge in the pasture for 4-6 hours per day. All the birds under both the systems had access to clean and fresh drinking water for 24 hours, at all the stages. Daily egg production (Hen day egg production –HDEP basis) was recorded from the day of 1st lay till to 40th week of age. The egg quality traits were studied at 40th week and were determined as per standard method.

Data analysis

Statistical analysis of data recorded was done using SPSS (V 25.0) computer package. Student t-test was used to analyze and find the significance level of different parameters. The differences between means were declared significant at $P \leq 0.05$.

Results and Discussion

The laying parameters and egg quality traits of Hansli x CSML cross under intensive and semi-intensive systems are presented in Table 1. The laying period was recorded from the age of first lay till 40th week of age.

Table 1: Laying parameters and egg quality traits of Hansli x CSML cross under intensive and semi-intensive systems

Parameters	Intensive system	Semi-intensive system
Age at sexual maturity (in days)	169.00±0.58^a	163.67±0.88^b
Egg production no. (up to 40 weeks of age)	36.46±0.33^a	28.71±0.62^b
Egg weight (g) (40th week)	48.93±0.57^a	46.73±0.56^b
Shape index (40th week)	77.63±0.20	77.44±0.15
Albumen index (40th week)	0.12±0.01^a	0.11±0.01^b
Haugh unit (40th week)	93.34±0.18^a	88.10±0.14^b
Yolk index (40th week)	0.46±0.001^a	0.43±0.001^b
Shell thickness (mm) (40th week)	0.37±0.02	0.35±0.01

^{a,b}Mean with different superscripts in a row differ significantly ($P \leq 0.05$)

N=25 (no. of eggs used as sampling for egg quality traits evaluation per system)

Age at sexual maturity

In the study, the age at sexual maturity for birds was 169.00±0.58 days and 163.67±0.88 days under intensive and semi-intensive system, respectively. These findings were higher than the findings reported by various workers like Moula *et al.* (2013) [9] and Padhi *et al.* (2015) [13] but were lower than the data recorded by others [4, 14]. The variation in the findings could be due to difference in genotype of the birds involved, feed intake and environmental conditions. The birds under semi-intensive system had a significantly lower ($P \leq 0.05$) body weight and age of sexual maturity than their intensive counterparts, which may be due to the fact that heavier birds attain late sexual maturity than lighter birds, as age at sexual maturity and body weight are negatively correlated, as reported by various workers [6, 8].

Egg production

The egg production of birds up to 40 weeks of age under intensive system was 36.46±0.33, which was significantly higher ($P \leq 0.05$) than their semi-intensive counterparts i.e., 28.71±0.62. Similar findings were reported by previous authors [15, 16] that egg production was improved under intensive system as compared to traditional rural systems. During the production period, broodiness was seen among the crosses under present study. Broodiness is a distinct character for desi and heavy birds. Broodiness and egg production are negatively correlated as reported by various authors [5, 7], which is why the egg production of crosses under present study was low. The egg production was lower under semi-intensive system as compared to intensive system, may be due to unavailability of adequate feed and nutrition.

External and internal egg qualities

The egg structure and its different parameters are imperative indications to interpret the egg quality, fertility, embryo development and diseases of the poultry. Egg weight, composition and its quality is influenced by various factors such as feed, breed, hormones, age and housing system as reported by various workers. In the present study, there was gradual increase in the egg weight with age under both systems which were in agreement to the findings of Padhi *et al.* (2013) [12]. The egg weight at 40th week of age was 48.93±0.57 g and 46.73±0.56 g for intensive and semi-intensive system, respectively. The eggs under intensive system weighed significantly more ($P \leq 0.05$) than those of semi-intensive system which corroborated with the findings of various authors [3, 14 and 15]. The lower egg weight under semi-intensive system may be due to inadequate nutrient

availability. The shape index of eggs under the two systems did not show any significant difference (P>0.05) which is in agreement with the findings of Oke *et al.* (2014) [11] and Patel *et al.* (2018) [14]. The shape index of egg observed in the study under both systems was found to be within normal range (72-78) [17]. The normal shape index indicates a normal shaped egg which is of aesthetic value to the consumers and it can be properly set in setter and show good hatchability. The rearing systems had significant effect (P≤0.05) on albumen index, yolk index and Haugh unit with higher values recorded under intensive system. These findings were in close conformity with the findings of Patel *et al.* (2018) [14]. The Haugh units in the present study were within normal range [17] but were of higher values than those reported for different cross by various authors [9, 10 and 11]. The higher Haugh unit values indicate superior quality of albumen of the cross under study. No significant difference (P>0.05) was observed in the shell thickness of eggs under the two, which is in agreement with the findings of Patel *et al.* (2018) [14]. Higher shell thickness is indicative of better suitability of the cross under study for traditional rural farming practices.

Conclusion

From the present findings, it can be concluded that rearing systems had a significant effect on egg production and different egg quality traits. The crosses under semi-intensive system showed earlier sexual maturity. The egg quality traits of crosses under study are desirable to withstand the traditional rural farming practices.

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Conflict of Interest

The authors declare that they have no conflict of interest.

Ethical approval

"The animal studies for the experiment have been approved by the ethics committee- IAEC, C.V.Sc & A.H., OUAT, Bhubaneswar, Odisha. (Regd. No.433CPCSEA/CVS/2007) and therefore have been performed in accordance with the ethics standards as applicable under international, national and/or institutional guidelines."

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